

Remarks

No new matter is added by the foregoing Amendments.

Claims 1-24 are pending. Claims 25-32 were previously withdrawn from further consideration by the Examiner as being drawn to a non-elected invention on the grounds that there is no allowable generic or linking claim. Reconsideration and allowance of all claims, as amended, are requested for the reasons discussed below.

The § 112, Second Paragraph, Rejections

Claims 11-15 were rejected under § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

The Examiner also objected to claim 9, as follows:

In claim 9, it is not clearly stated that the first and second convection chambers are related to the at least one convection chamber in claim 2. The claim should state: wherein the at least one convection chamber comprises a first convection chamber and a second convection chamber, and at least one duct connects the first convection chamber with the second convection chamber.

In view of the above objection, Applicants have amended claim 9 to more clearly state the relationship of the elements set forth in claim 9.

Claim 14 has been amended by changing "first" to - - second - - in claim 14 to correct an inadvertent error. This correction conforms with the description of the invention set forth in the specification and drawings.

Claims 11, 12, 13, 14, and 15 have been amended to address the Examiner's rejection of claims 11-15 under § 112, second paragraph. As amended, the claimed apparatus now includes a flow of a mixed-feed in claims 11-15, plus a flow of a product synthesis gas in claims 14 and 15.

Dependant claims 9 and 11-15, as amended, more clearly define Applicants' invention. Accordingly, the objection to claim 9 and the rejection of claims 11-15 under § 112 should be

withdrawn.

The § 103 Rejections

The Examiner rejected claims 1, 2, 4-10, 16, 18-20, 22, 23, and 24 under § 103(a) as being unpatentable over Bruck (U.S. Pat. No. 4,440, 727) in view of Stahl (U.S. Pat. No. 6,136,279).

With regard to independent claims 1 and 2, the Examiner acknowledged that Applicants' invention is different from the primary reference (Bruck) in that: "... Bruck does not disclose this second chamber as a reaction chamber." After stating that "Stahl discloses reformer reaction tubes (8) in a convective reaction chamber," the Examiner concluded that: "It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the reformer reaction tubes of Stahl in the second (convective) chamber of Bruck since this would increase reactor throughput."

However, the § 103 rejection of claims 1 and 2 is improper because there is no teaching, suggestion, or motivation to combine the cited references to produce Applicants' claimed invention. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 682, 16 USPQ2d 1430, 1432 (Fed. Cir. 1990); *In re Fritch*, 972 F.2d 1260, 1265-66, 23 USPQ2d 1780, 1783-84 (Fed. Cir. 1992); *In re Kotzab*, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1316 (Fed. Cir. 2000). Since the prior art does not suggest the desirability of combining the cited references, the Examiner has not made a *prima facie* case of obviousness.

Accordingly, for the above reasons, the rejection of claims 1 and 2 under § 103 should be withdrawn.

With regard to independent claim 16, the Examiner rejected that claim stating that "Stahl discloses the reaction tubes as reformer tubes (8)." However, the rejection of independent claim 16 is improper for the same reasons that the rejection of independent claims 1 and 2 is improper. Specifically, there is no teaching, suggestion, or motivation to combine the cited references (Bruck

and Stahl) to produce Applicants' claimed invention. Since the prior art does not suggest the desirability of combining the cited references, the Examiner has not made a *prima facie* case of obviousness.

Moreover, it is improper to combine Bruck and Stahl because those references do not address or solve the problems addressed by Applicants' claimed invention, nor do the references appreciate the advantages of Applicants' claimed invention. Therefore, the § 103 rejection of independent claims 1, 2, and 16 based on the combination of Bruck with Stahl is inappropriate. *See, In re Fine*, 837 F.2d 1071, 1075-76, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988); and *Diversitech Corp. v. Century Steps, Inc.*, 850 F.2d 675, 679, 7 USPQ2d 1315, 1318 (Fed. Cir. 1988) (problem confronted by the inventor must be considered in determining whether it would have been obvious to combine references in order to solve that problem).

For example, Applicants' claimed invention addresses, *inter alia*, the problem of utilizing the high grade sensible heat of flue gas and product synthesis gas to generate additional product gas and minimize steam export. Neither Bruck nor Stahl address that problem. Bruck is directed to a tube furnace for the performance of gas reactions, especially for the production of hydrocyanic acid according to the BMA process. Although Stahl does involve a reformer furnace for steam reforming, the object of Stahl's invention is to provide a reformer furnace that releases heat to the tubes from a large surface of uniform high temperature rather than from a small and very hot volume of a flame (col. 1, ll. 25-28). Since these two references, individually or in combination, do not address the problems solved by Applicants' claimed invention or appreciate the advantages of Applicants' claimed invention, these references cannot be used to render obvious any of the pending claims (claims 1-24).

The Examiner also rejected dependent claims 4-10, 18-20, and 22-24 for the following reasons:

Referring to claim 4 and 5, Bruck and Stahl disclose vertical reaction chambers.

Referring to claims 6 and 7, Stahl discloses a reaction chamber that is a tube-in-tube.

Referring to claim 8 and 22, Bruck discloses an assembly with multiple units.

Referring to claims 9, 10, 23 and 24 Bruck discloses ducts connecting first and second convection chambers and a convection pass (5) communication with the ducts.

Referring to claim 16, Stahl discloses the reaction tubes as reformer tubes (8).

Referring to claim 18, Bruck discloses an assembly with multiple units.

Referring to claims 19 and 20, Bruck discloses ducts connecting first and second convection chambers and a convection pass (5) in communication with the ducts.

However, since independent claim 2 is non-obvious under § 103, dependent claims 4-10 which depend from claim 2 also are non-obvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988).

Similarly, since independent claim 16 is non-obvious under §103, claims 18-20 which depend from claim 16 also are non-obvious. *In re Fine, supra*. Likewise, since independent claim 1 is non-obvious under § 103, claims 22-24 which depend from claim 1 also are non-obvious. *Id.*

Accordingly, for all of the above reasons, the rejection of claims 1, 2, 4-10, 16, 18-20, 22, 23 and 24 under § 103 as being unpatentable over Bruck in view of Stahl should be withdrawn.

The Examiner also rejected claims 3, 17, and 21 under § 103(a) as being unpatentable over Bruck and Stahl as applied to claims 1, 2, 4-10, 16, 18-20, 22, 23 and 24, and further in view of Tsai (U.S. Pat. No. 4,792,436). The Examiner acknowledged that Bruck and Stahl do not disclose "a

communication means between the first reaction chamber and the second reaction chamber.” After stating that “Tsai discloses communication means (16) between first reaction chamber (11a) and a second reaction chamber (11b),” the Examiner concluded that: “It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the communication means between the chambers disclosed by Tsai in the apparatus of Bruck to utilize the sensible heat from the flue gas produced by the furnace for heating the feed to reaction chamber.”

Applicants respectfully disagree with the Examiner. Tsai does not disclose communication means between the first reaction chamber and a second reaction chamber. Rather, that reference discloses communication means between a convection section and a radiant section.

Moreover, the § 103 rejection of claims 3, 17, and 21 is improper because there is no teaching, suggestion, or motivation to combine Tsai with Bruck and/or Stahl. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests that desirability of the combination. *In re Mills, supra*; *In re Fritch, supra*; *In re Kotzab, supra*. Since the prior art does not suggest the desirability of combining the cited references, the Examiner has not made a *prima facie* case of obviousness.

Furthermore, since independent claims 1, 2, and 16 are non-obvious under § 103 (for the reasons discussed above), claims 3, 17, and 21 which depend from claims 1, 2, and 16 also are non-obvious. *In re Fine, supra*. (Claim 3 depends from claim 1; claim 17 depends from claim 16; and claim 21 depends from claim 1.)

Accordingly, for all of the foregoing reasons, the rejection of claims 13, 17, and 21 under § 103 as being unpatentable over Bruck and Stahl and further in view of Tsai should be withdrawn.

The Examiner also rejected claims 11, 12, and 13 under § 103(a) as being unpatentable over Bruck and Stahl as applied to claims 1, 2, 4-10, 16, 18-20, 22, 23 and 24, and further in view of Arisaki, *et al.* (U.S. Pat. No. 5,181,990). The Examiner acknowledged that Bruck and Stahl do not disclose a limitation of Applicants’ claimed invention - - “feed flowing co-currently with the flue gas in

the combustion chamber and feed flow counter-currently with flue gas in the convection chamber.”

However, the Examiner stated that:

Arisaki discloses feed entering the bottom of a furnace chamber flowing co-currently with the flue gas (Figure 1). Arisaki also discloses feed flowing counter-currently with the flue gas in the convection chamber (6).¹

The Examiner then concluded that: “It would have been obvious to one having ordinary skill in the art at the time the invention was made to flow feed co-currently with flue gas in the combustion chamber of Bruck since this raises the temperature of the fluid at the inlet thereby shortening the retention time of hydrocarbons inside the surface as taught by Arisaki.”

However, the § 103 rejection of claims 11, 12, and 13 is improper because there is no teaching, suggestion or motivation to combine Arisaki with Bruck and/or Stahl. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills, supra*; *In re Fritch, supra*; *In re Kotzab, supra*. Since the prior art does not suggest the desirability of combining the cited references, the Examiner has not made a *prima facie* case of obviousness.

Furthermore, since independent claim 2 is non-obvious under § 103 (for the reasons discussed above), claims 11, 12, and 13, which depend from claim 2 also are non-obvious. *In re Fine, supra*. (Claim 11 depends from claim 2; claims 12 and 13 depend from claims 6 and 7 respectively, and both claims 6 and 7 depend from claim 2.)

Accordingly, for all of the above reasons, the rejection of claims 11, 12, and 13 under § 103 as being unpatentable over Bruck and Stahl and further in view Arisaki should be withdrawn.

The Examiner also rejected claims 14 and 15 under § 103(a) as being unpatentable over Bruck, Stahl, and Arisaki as applied to claims 1, 2, 4-13, 16, 18-20, 23 and 24, and further in view of

¹ What the Examiner refers to as “a convection chamber” is actually a convection coil (col. 3, l. 68), not a convection chamber.

MaKabe, *et al.* (U.S. Pat. No. 5, 226,928). The Examiner acknowledged that Bruck, Stahl and Arisaki do not disclose one of the limitations of Applicants' claimed invention - - "feed flowing in an annular portion of a tube-in-tube reactor chamber and a product gas flowing in an inner tubular portion of the tube-in-tube reactor chamber counter-currently to the feed." However, the Examiner concluded that this limitation is disclosed in MaKabe and that it would have been obvious to one having ordinary skill in the art at the time the invention was made to use MaKabe's flow arrangement with the apparatus of Bruck since this improves heat efficiency as taught by MaKabe.

However, the § 103 rejection of claims 14 and 15 is improper because there is no teaching, suggestion or motivation to combine MaKabe with Bruck (or Stahl, Arisaki, or any combination of the cited references). The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior also suggests that desirability of the combination. *In re Mills, supra*; *In re Fritch, supra*; *In re Kotzab, supra*. Since the prior art does not suggest the desirability of combining the cited references, the Examiner has not made a *prima facie* case of obviousness.

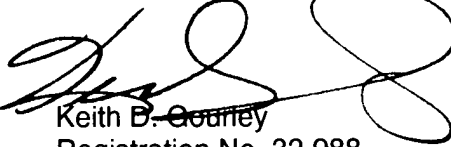
Furthermore, since independent claim 2 is non-obvious under § 103 (for the reasons discussed above), claims 14 and 15, which depend from claim 2, also are non-obvious. *In re Fine, supra*. (Claims 14 and 15 depend from claims 12 and 13, which depend from claims 6 and 7, which depend from claim 2.)

Accordingly, for all of the above reasons, the rejection of claims 14 and 15 under § 103 as being unpatentable over Bruck, Stahl, Arisaki, and further in view of MaKabe, *et al.* should be withdrawn.

Conclusion

For all of the foregoing reasons, Applicants submit that all of the pending claims, as amended, are patentable over the art of record. Withdrawal of the rejections is respectfully requested, and an early Notice of Allowance is earnestly solicited.

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW THE CHANGES MADE

In the Specification

The paragraph beginning at line 16 of page 11 has been amended as follows:

- - Conventional reformer radiant tubes 22 or conventional tube-in-tube devices 26 with catalyst in their annuli are used in the combustion chamber 16 to utilize high intensive radiant heat directly from the flame of the burner(s) 24. Conventional reformer catalyst tubes [26] - - tube-in-tube devices 26 with catalyst in their annuli, or tube-in-tube devices 26 that connect with the radiant tubes from the combustion chamber to receive the hot product gas from the radiant tubes - - are placed in the convection chambers 18 to recover the sensible heat from the flue gas and the product gas from the reforming reaction. - -

In the Claims

Claims 9 and 11-15 have been amended, as follows:

9. (Amended) An assembly as in claim 8, wherein the at least one convection chamber in at least one of the multiple units comprises [further comprising at least one duct connecting] a first convection chamber and a second convection chamber, [of said] and at least one duct connects the first convection chamber [in at least one unit] with the second convection chamber.

11. (Amended) An apparatus as in claim 2, further comprising a flow of a mixed-feed, wherein a first portion of [a] said mixed-feed flows through said first reaction chamber co-currently with a flow of said flue gas in said combustion chamber, and a second portion of said mixed-feed flows through said second reaction chamber counter-currently with said flow of said flue gas in said convection chamber.

12. (Amended) An apparatus as in claim 6, further comprising a flow of a mixed-feed, wherein a first portion of [a] said mixed-feed flows through said first reaction chamber co-currently with a flow of said flue gas in said combustion chamber, and a second portion of said mixed-feed flows through said second reaction chamber counter-currently with said flow of said flue gas in said convection chamber.

13. (Amended) An apparatus as in claim 7, further comprising a flow of a mixed-feed, wherein a first portion of [a] said mixed-feed flows through said first reaction chamber co-currently with a flow of said flue gas in said combustion chamber, and a second portion of said mixed-feed flows through said second reaction chamber counter-currently with said flow of said flue gas in said convection chamber.

14. (Amended) An apparatus as in claim 12, further comprising a flow of a product synthesis gas, wherein said [first] second portion of said mixed-feed flows in an annular portion of said tube-in-tube, and [a] said product synthesis gas flows in an inner tubular portion of said tube-in-tube counter-currently with said [first] second portion of said mixed-feed.

15. (Amended) An apparatus as in claim 13, further comprising a flow of a product synthesis gas, wherein said first portion of said mixed-feed flows in an annular portion of the tube-in-tube, and [a] said product synthesis gas flows in an inner tubular portion of said tube-in-tube counter-currently with said first portion of said mixed-feed.